

## Final Report on NASA Grant NAG5-3144

712-84-012

OUT

206 343

Date of Report: July 9, 1997

NASA Grant Number: NAG5-3144

Reporting Period: November 15, 1995 - November 14, 1996

p2

Title of Grant: VW Hydri in Outburst and Quiescence

Institution Name: American Association of Variable Star Observers (AAVSO)

Principal Investigator: Dr. Janet Akyüz Mattei

## Final Technical Report

The goal of this project was to provide optical data support for the observations with the EUVE satellite of two dwarf nova-type cataclysmic variables, VW Hydri and SS Cygni. The optical data support was necessary in order to start observations and to correlate the data obtained by the EUVE satellite on these stars. In the case of VW Hydri, the object was to observe the star with EUVE during a superoutburst, which is a long and bright eruption that lasts 15-20 days and occurs about every six months, during a normal outburst, which lasts 2-3 days and occurs about every four weeks, and during its minimum state, or quiescence, in order to understand the mechanism that causes the outburst and to study the flux that is produced in the boundary layer between the disk and the white dwarf of this close binary system. For SS Cygni, which had already been observed with the EUVE during a slow-brightening, anomalous outburst, the goal was to observe the star with the EUVE during a normal outburst to see if there is any difference in the EUV emission between outbursts.

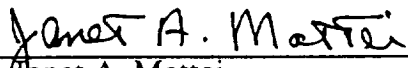
To provide the optical data support, the Principal Investigator for the optical observations, J. A. Mattei, predicted the eruptions and their types of VW Hydri and SS Cygni by analyzing 25 years of optical data on these stars from the AAVSO International Database. Following this analysis, prior to the EUVE windows for the observations of these two stars and throughout the observing windows, PI J. Mattei sent out seven AAVSO Alert Notices, which are special AAVSO publications designed to request observations from observers, alerting 450 observers around the world to monitor VW Hydri and SS Cygni in a specific way in order to provide the data support. These Alert Notices were sent between February 1994 and June 1995.

In response to the Alert Notices, during the EUVE observing windows observers regularly telephoned, e-mailed, or faxed to AAVSO their optical observations of VW Hydri and SS Cygni, and immediately as soon as either of these stars started to erupt. From these incoming observations, PI J. Mattei studied the behavior of VW Hydri, in order to decide whether the outburst was a superoutburst or a normal one, and the behavior of SS Cygni in order to decide that the outburst was a normal one, not an anomalous, asymmetric one, and then advised the Principal Investigator of the EUVE observations, Dr. Christopher Mauche, as to the nature of the outbursts so that the decision could be made whether or not to start the satellite observations.

As a result of the close monitoring by observers and the immediate notification of the eruptions to the PI at EUVE, and the very fast response of the EUVE satellite operations center, VW Hydri was observed with EUVE during a superoutburst in June 1994, during a normal outburst in July 1995, and during quiescence in August 1995, and SS Cygni was observed with EUVE in June-July 1994 during a normal outburst.

All of the EUVE observations were extremely successful. The most impressive observations were those of VW Hydri during a normal outburst on July 7, 1995, when EUVE observations started just 3.75 hours after PI J. A. Mattei called the NASA Deputy Project Scientist, Dr. R. Oliverson, informing him that the eruption of this star had started. The AAVSO optical observers also provided impressive optical coverage, including observations made with charge-coupled devices (CCDs). The satellite observed VW Hydri continuously for 11 days, and obtained unprecedented data throughout the outburst and into quiescence. In addition to the EUVE satellite, the Voyager satellite also was able to point to VW Hydri at the start of the eruption and obtained far UV observations during this narrow outburst. A spectacular multiwavelength light curve of VW Hydri was compiled from EUVE and Voyager satellite data and AAVSO optical data. The EUVE data indicated clearly that the EUV outburst started about 0.5 day after the optical outburst started.

Following the EUVE observations, in order to correlate the satellite observations with the optical data, the thousands of optical observations of VW Hydri and SS Cygni that were sent to the AAVSO by observers around the world during the observing window were transmitted to the EUVE PI C. Mauche. Several collaborative papers are being prepared of the results of these studies. In addition, C. Mauche and J. Mattei have given joint invited talks at scientific meetings on their successful collaboration and the impressive results obtained with the EUVE satellite on the two stars.

  
\_\_\_\_\_  
Dr. Janet A. Mattei  
Director, AAVSO  
Principal Investigator, NAG5-3144